Land Cover Discrimination Using Sarex Data

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ABSTRACT

During SAREX campaign in 1992, SAR images were acquired over the Tapajós region in Brazil. In this paper the preliminary results of SAREX visual analysis are presented, and compared to results of visual analysis of TM data. The results permit the conclusion that the strength of high resolution C-band SAR imagery over rain forest is its texture information, being the average grey level not too much informative.

1. INTRODUCTION

This work presents a preliminary evaluation of SAREX images acquired over the Tapajós region, located in Pará state, Brazil. During the SAREX mission, this site was imaged by the Convair 580 SAR system, (owned by Canadian Centre for Remote Sensing-CCRS) in the C band frequency and three different operating geometries. It provided the first opportunity for scientific study of tropical forest signatures at C band using high resolution airborne SAR.

The study site includes the Tapajós National Forest (Flona) located south of the city of Santarém, in the Pará state. It comprises approximately 600,000 hectares of tropical rain forest. At the border of Flona there are several areas which have been deforested as a result of human activity.

At this site, a project is being conducted to evaluate the use of SAR data for land cover characterization (vegetation types, deforestation, regeneration, pasture, etc.) based upon visual and digital analysis and field work. The field work was carried out in August, 1993 to identify visually classified units and included airborne photography of representative targets. In this paper the preliminary results of SAREX visual analysis are presented, and compared to results of visual analysis of TM data, with respect to the suitability of using the different sensors for discrimination of the different classes observed on the ground.

2. SAREX DATA

The SAR data over Tapajós study site was acquired on April 16, 1992. The SAR 580 system is a well established airborne X/C-Band SAR facility which has been used widely within North America and Europe (Shimabukuro et al., 1993).

During SAREX'92 campaign in Brazil the aircraft operated from an altitude of approximately 6 km using a single frequency mode (C-Band) in dual polarization (HH and VV) and 3 different imaging modes: Nadir mode - 20km swath (incidence angles 20° to 74°) with 6m x 6m resolution covering 56 km length; Narrow swath mode - 18 km swath (incidence angles 45° to 76°) with 6m x 6m resolution covering 172 km and 60 km length; Wide swath mode - 60 km swath (incidence angles 45° to 85°) with 10m x 20m resolution covering 238 km length. (Shimabukuro et al., 1993). Landsat TM is also available as an ancillary data source to help feature identification.

3. STUDY AREA

The Tapajós National Forest (Flona) is under the administration of the Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA). Its geographic co-ordinates are: S 2° 40' to S 4° 10' and W 54° 45' to W 55° 00'. To the north the area is bordered by a line that links Km 50 of the Santarém-Cuiabá highway to the point on the bank of the river Tapajós of latitude S 2° 45'. To the east the area is bordered by Santarém-Cuiabá highway from Km 50 until Km 205 (close to the municipality of Rurópolis). To the south, it is bordered by the rivers Santa Cruz (or Cuparitinga) and Cupari, until its mouth in the Tapajós river. To the west, it is bordered by the Tapajós river (Figure 1).

The lithology, morphology, soils and climate are responsible to physiognomic and floristical aspects of the Dense Tropical Forest. According to Projeto Radambrasil, 1976, geomorphologically, this forest partially covers the ecological sub-region Lower Amazon Plateau (LAP) and the ecological sub-region Higher Xingu-Tapajós Plateau (HXTP).

Based on physiognomic and floristical characteristics, the LAP can be divided into two ecosystems: Lower Plateau Ecosystem (LPE) and Ecosystem of the Dissected Lower Plateau (EDLP). The first ecosystem occurs in an area of lowlands with low relief variance and predominantly clay-rich soil. The second ecosystem in the LAP consists of intensively dissected plateaus with erosion on the slopes, narrow valleys and soils with a medium texture.

The second geomorphologic unit (HXTP) is characterized by dense tropical forest with trees having a high commercial value.

4. GROUND DATA ACQUISITION.

The ground trip was focused along the Cuiabá-Santarém highway, as the predominant land cover types were present in this region. Geographic co-ordinates were obtained, using GPS, for all points of interest and crossing roads, to help target localization on maps and TM colour composites. These co-ordinates will also be used to help image registration. A second trip was made along a secondary road, which links km 92 of the Santarém-Cuiabá highway with the Tapajós river, crossing Tapajós National Forest and passing through São Jorge village.

Aerial photos of different forest types, regeneration and degraded areas and pasture were acquired using a 35 mm Minolta photographic camera, in the nadir position, using 50 mm lenses. The altitude was 1500 m and scale was approximately 1:4,800. Geographic co-ordinates, using GPS, were obtained for each aerial photo.

5. VISUAL DATA ANALYSIS.

Based on the classical photo-interpretation criteria, tone and texture, SAREX narrow swath transparencies at 1:80,000 scale and

Similarly, TM colour composites (WRS 227/62), quadrants A and C, overpass July 29, 1992, bands 3 (B), 4 (G) and 5 (R), at the scale 1:100,000, were also analysed.